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ROCKS and MINERALS

A Magazine for Mineralogist, Geologist and Collector . . .

. . . . . *Official Journal of The Rocks and Minerals Association*

APRIL, 1938

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THE ROCKS AND MINERALS ASSOCIATION

PEEKSKILL, N. Y.

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Organized in 1928 for the increase and dissemination of mineralogic knowledge.

To stimulate public interest in geology and mineralogy and to endeavor to have courses in these subjects introduced in the curricula of the public school systems; to revive a general interest in minerals and mineral collecting; to instruct beginners as to how a collection can be made and cared for; to keep an accurate and permanent record of all mineral localities and minerals found there and to print same for distribution; to encourage the search for new minerals that have not yet been discovered; and to endeavor to secure the practical conservation of mineral localities and unusual rock formations.

Ever since its foundation in 1928, the Rocks and Minerals Association has done much to promote the interest in mineralogy. It has sponsored outings, expeditions, formations of mineralogical clubs and the printing of many articles that have been a distinct contribution to mineralogy.

Those of our readers who are members of the Association can rightly feel that they too were sponsors of these many achievements that have helped to give mineralogy a national recognition. Among your friends there must be many who would like to have a part in the Association's work—to share with you the personal satisfaction, the pleasure, and the benefits of membership. Will you give your friends this opportunity to join the Association by nominating them for membership? A nomination blank will be found elsewhere in this issue.

Each new member helps to extend the Association's activities—helps to make your magazine larger,better, and more interesting, and above all assists in the dissemination of mineralogical knowledge.

Some advantages of membership: All members in good standing receive:

(1) **Rocks and Minerals,** a monthly magazine. (2) A member's identification card that secures the privileges of many mines, quarries, clubs, societies, museums, libraries. (3) The right to participate in outings and meetings arranged by the Association. (4) The right to display a certificate of membership and to place after their names a designation indicating their membership or to advertise membership on stationary, etc. (5) The distinction and the endorsement which comes from membership in the world's largest mineralogical society.

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Queens Mineral Society, Miss Bernadette Reis, Sec., 10314-97th Ave., Ozone Park, L.I., N.Y.

ROCKS and MINERALS

PUBLISHED MONTHLY

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APRIL 1938

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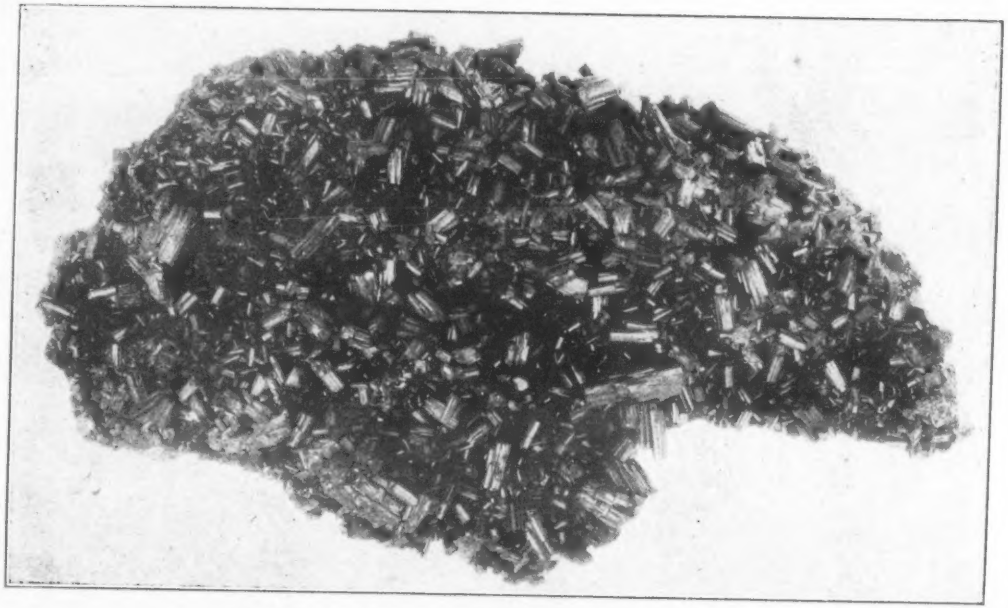

Courtesy U. S. National Museum.

VANADINITE
Old Yuma Mine, Near Tucson, Arizona.

VANADINITE

A mineral famed for its beauty is the chloride and vanadate of lead known as vanadinite. Its fame is well deserving for when it is found in a gorgeous aurora of orange red it is truly one of the most spectacularly beautiful of minerals. A peculiarity of its crystals is their curious habit of being hollow at the top, similar to pyromorphite, as if they seldom had enough material to finish their growth.

The mineral was first discovered at Zimapan, Mexico, in 1801 by Del Rio. At that time vanadium was not known but Del Rio noted the new element in his analysis and called it erythronium. Later when his analysis was attacked by others he became doubtful of his own work and decided that erythronium was merely impure chromium.

In 1830, Sefstrom discovered a new element in the iron ores of Taberg, Sweden, and called it vanadis, a surname of the Scandinavian goddess, Freya. This later became known as vanadium.

In the same year, 1830, Wöhler proved that erythronium in the Zimapan mineral was identical with vanadium.

The finest vanadinites in America, if not in the world, are found in Arizona and New Mexico where they usually occur in the oxidized zones of lead deposits and are generally regarded as secondary minerals formed by the oxidation of galena.

Magnificent specimens of vanadinite, usually associated with wulfenite, have been found at the old Yuma lead mine in Pima County, approximately 15 miles northwest of Tucson, Arizona. In the same state, brilliant, deep red crystals have been found at the Hamburg, Melissa, and other mines in Yuma County; at Globe in Gila County; at the Vulture, Phoenix, and other mines in Maricopa County; at the Black Prince mine, also from the Mammoth gold mine, near Oracle, Pinal County; in brown barrel-shaped crystals in the Humbug district, Yavapai County. In the Cataract Canyon, Coconino County, vanadinite is sometimes found as a minutely thin layer on quartz crystals. These layers break easily from the crystals and those sides originally in contact with the quartz have the appearance of a highly polished metal. Specimens of this kind are known as "vanadium mirrors" but they tarnish and lose their luster after being out of the ground for several months.[1]

In New Mexico, very fine specimens of vanadinite (endlichite) occur at Lake Valley, Sierra County. Endlichite was named after Dr. F. M. Endlich.

Vanadinite has been found in various other section of the United States as in California near Searles Lake; associated with galena and mimetite near Randsburg; at Camp Signal, near Goffs, in the Vanadium King mine associated with cerussite and cyprodescloizite. In Idaho, in the Spring Mountain district of Lemhi County at the Iron Mask mine. In New York, at the old Sparta lead mine, one mile south of the Ossining railroad station, where it was associated sparingly with wulfenite and pyromorphite as a coating on limestone. At the old Wheatley lead mines of Chester County, Penn.

Many foreign localities for the mineral are known. In South West Africa, rich red crystals of vanadinite, some over 5 inches long, have been found. Though these represent some of the largest crystals known of vanadinite, and possess good color, the minerals often lack beauty because of a thick encrustation of descloizite.

CHIPS FROM THE QUARRY

PETER ZODAC

Our Trip South

We took two weeks off last month, laid aside all cares and worries of editorial duties, and went on a mineral collecting tour through some of the southern states. Our plan, originally, was to go to Roswell, New Mexico, but we finally decided we could not make that trip conveniently during the few days at our disposal. So we compromised by going south.

We left Peekskill, N. Y., Wed. March 9th, at 12:30 p.m. and returned Wed. March 23rd, at 6:45 p.m. Our journey took us through ten states, we visited 26 localities, and covered 3165 miles.

The trip was a grand success in many ways. It enabled us to visit loalities new to us where we collected many interesting specimens; to visit museums where we saw many more; and to visit nine subscribers, most of whose collections were also examined. The subscribers visited were: Rev. Robert B. Owens, Charlotte, N.C.; Bradley Johnson, Penland, N.C.; R. B. Ballew, Little Switzerland, N.C.; J. L. Hicks, Highlands, N.C.; Prof. Fred Calhoun, Clemsen College, S.C.; Mr. and Mrs. C. D. Gibson, Atlanta, Ga.; J. R. Lee, Bridgejort, Ala.; W. W. Ward, Centre, Ala.; and Ralph J. Magri, Lynchburg, Va.

The trip was also the means of making a number of very good friends who not only guided us to mineral localities of their vicinity but made our trip a most enjoyable one. To four of these friends, Mr. Wm. Alexander of Spruce Pine, N.C.; Mr. and Mrs. Ellis C. Soper of Franklin, N.C.; and Prof. J. G. Lester of Emory University, Ga., we are especially grateful.

Of the localities visited, Spruce Pine, N.C., Graves and Stone Mountains, Georgia, were outstanding. Near the heart of the city of Charlotte, N.C., (population 82,675), the largest city in the Carolinas, we saw its active gold mine. It was odd to see the headframe of the vertical shaft surrounded by city buildings on all sides. This is the Rudisil gold mine and we collected a number of specimens from its tiny dump.

The trip convinced us of the importance of mineral collectors. Were it not for those we contacted our trip would have been a failure. Literature in general gives but little information on the location of interesting occurrences of minerals while state and government agencies are almost useless. It is the mineral collector who knows of interesting localities of his area, how they may be reached and what specimens may be found. Though we have a large number of subscribers in the south, we must strive to make more of them active mineral collectors.

Peter Zodac

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WHOLE NO. 81

USE OF THE SPECTROGRAPH IN MINERALOGY

By THOMAS A. WRIGHT, Technical Director

Lucius Pitkin, Inc. - Chemists - Assayers - Spectroscopists.

The mineralogists, amateur or tyro, who come in contact with scientific workers in Chemistry, Physics, Metallurgy or Astronomy may perhaps have an idea as to the growing number of uses to which this modern instrument is being put. It is hardly likely that this is true of the bulk of amateur mineralogists, so that a short description of this fascinating if expensive tool of investigation and identification is in order if one is to understand how, why, when and by whom it may be used.

The spectrograph is a spectroscope to which is connected a camera so that the results obtained may be a matter of permanent record. The peculiar value of the spectroscope lies in its ability to break up light into its constituent parts or wavelengths and, generally speaking, the greater the ability of a certain type of spectroscope to resolve and distinctly separate these individual wavelengths of light one from its neighbor, the better the instrument. This remark about light does not imply that the instrument is used to determine the color of minerals, though it is used for that purpose in connection with studies on dyes. What it does mean will soon appear.

There are two main types of spectrographs. In one the prism is used to break up the light and in the other the ruled grating is employed. The former is the one used in the Pitkin Laboratories and most industrial research laboratories. It is also rapidly growing in use in many factory or plant control laboratories. The grating instrument on the other hand has been until recently a tool only of such great scientific laboratories as those at the Bureau of Standards or the Massachusetts Institute of Technology. The grating type has been the most expensive as to original cost, installation, space required, etc., but is being rapidly improved and adapted to routine and commercial requirements and there are now two types of convenient and compact instruments available and in use, though the cost runs into four figures also.

In the prism instrument there are two types. In one the light entering (as is common in any spectroscope) a narrow slit (say .0004") passes right through the prism to the camera plate holder and is then recorded or photographed. Figure No. 1 is a spectrogram in the range A. U. This prism, which serves to break up the light, may be either glass or quartz. Either must be free from flaws. The quartz prisms are usually made from carefully selected, cut and polished rock-crystal from Brazil.

In the second type, the back of the prism, whether glass or quartz, is silvered to serve as a mirror. The light entering this type (known as a Littrow prism), therefore, is reflected back to the front of the instrument, thus permitting a greater photographic enlargement of the spectrum. Put another way, the Littrow instrument has a greater ability to disperse the light than the plain or former type.

Again, quartz, which has a lower dispersion than glass, is superior in that it passes ultra-violet light and it is in that

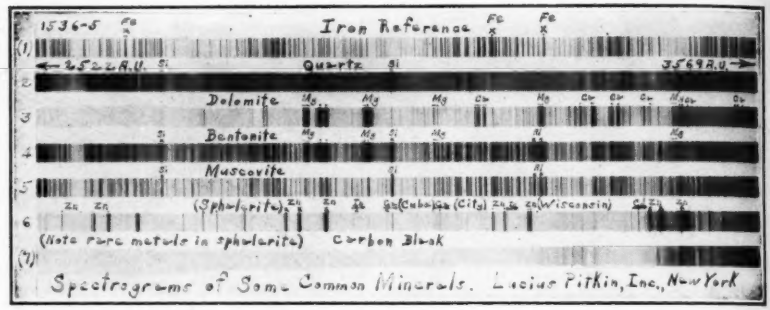


Fig. 1.

portion of the spectrum that the mineralogist is most interested for there will be found most of the spectral lines which we must indentify or measure. In passing, it may be stated that the quartz prism spectrograph covers the area of the spectra between 2000 and 7000 Angstrom Units. (The Angstrom Unit used to measure the wavelengths of light equa's .000000-003937"). Light does not become visible to we mortals much below 4000 A. U. and becomes visible again at 8000 A. U. 2000 A. U., therefore, represents the U. V. or ultra-violet end and the 7000 A. U. the infra-red.

While the phenomenon of light, as we are to consider it here, is quite different from Fluorescence, yet to readers **of** Rocks and Minera's **a temporary diversion** should be in order. Reference is made to the exposure of Hackmanite to light of the U. V. (or "cold") type to bring out the rose or rose-purple color and contrariwise to exposure to the infra-red (or heat wave) type to reverse or decolorize thus giving the outstanding, but perhaps not only, (1) example of a reversibly photo-sensitive mineral as described by an associate of the author (2)

Now to get back to our discussion of the various types of spectrographs. In the grating spectrograph we depend not upon the resolving and dispersion properties of a prism but upon a concave mirror upon which is ruled, at great expense of time, skill and instrumentation, a series of lines which may range from say 10000 to 25000 per inch. When the light permitted to come through the slit hits this series of rulings, it too is broken up but in a manner quite different but in many ways more satisfactory than with the prism. In plain words, any 100 A. U. in the grating photograph or spectrogram will occupy the same length on a plate irrespective of whether it represents the U. V. or the I. R. end. On the other hand, in the prism instrument while a 100 A. U. might occupy on inch of the photographic plate down at the U. V. end, the lines tend to become more and more crowded as one approaches the I. R. end, so that at say 7000 A. U. an inch might suffice to photograph 300 or 400 A. U.

Now we have been talking about light but have not said how we got it. And we have also been confining ourselves to what is known as emission spectrography what is known as emission spectrography

(1) The Terlingua Quicksilver District of Brewster County, Texas, by Frank Duncan. ROCKS and MINERALS. Vol. 12, No. 11, Whole No. 76, November 1937, pp. 325-332. On page 330, Kleinite is described as follows: (Dana's System, Appendix 2, p. 59): "Occurs in small prismatic crystals yellow to orange in color. The mineral has the peculiar property of *changing its color when exposed to light* (darkening immediately to reddish orange) *but regaining its original color when placed in the dark*: streak same as color. H. 3.5 Sp.Gr. 7.9. A mercury ammonium chloride of uncertain composition."

(2) A New Property of Matter: Reversible Photosensitivity in Hackmanite from Bancroft Ontario, by O. Ivan Lee. *American Mineralogist*, Vol. 21, No. 12, pp. 764-776, December 1936.

THE LARGE LITTROW SPECTROGRAPH

Courtesy Bausch & Lomb.

Nor is it the purpose of this article to go into the question of X-ray diffraction spectrography as referred to by Professor Palache recently in a notable address at the Mineralogical Congress describing the forthcoming edition of Dana and the changes and trends of modern mineralogical research. This latter type of spectrography refers particularly to the innate crystallographic nature and atomic structure of a mineral and is of peculiar value for example in distinguishing between Bentonite and other chemically similar but physically dissimilar clays. Absorption spectrography depends upon the ability to distinguish one substance from another by the selective absorption and in the passage of light of known character through a solution, either liquid or solid. Its use as to minerals is, therefore, considerably restricted to clear crystals of a non-opaque character.

Emission spectrography depends upon photographing the light emitted by the suitable excitation of either a piece of solid material or a solution of the whole or part of the substance to be examined. This can be done because each element (this earth can for convenience be said to be made up of some 90 odd elements) when heated to a sufficiently high temperature or when otherwise suitably excited is, according to one theory, energized to the extent that electrons may be temporarily displaced from one orbit to another. Each element gives its own characteristic light pattern. This pattern or spectrum is composed of many individual lines, each of which for a given element is always of identical wavelength and, therefore, always are to be found and photographed i n t h e same position, though not all lines of an element are in the spectral range we have described and some, like those of Selenium, never reach the photographic plate or the eye unless the excitation is carried out in a vacuum.

Fortunately, however, we can thus identify **any** metal so that given an unknown sample of a mineral, a rock or an ore we can take a small piece, or better still for some purposes a finely ground powder, and by burning tell every metal that is present. We can even tell if Phosphorus or Fluorine is present but we cannot tell by ordinary spectroscopy as it is more commonly employed, unfortunately, whether oxygen or sulphur, for example, is, though by burning in a vacuum one can tell all the elements. The method **will not disclose** in what form or compounds the elements are found associated in a specimen though it may suggest certain inferences. Nevertheless, it must be obvious what an extraordinary tool the assayer, chemist, metallurgist or mineralogist now has at his command, for the value (and at the same time perhaps a danger) lies not only in the fact that all the elements present are disclosed but because the most minute amounts show up. Even say to 1 part in a million or a billion for the matter.

The spectroscopist, therefore, and this is important if hopes are not to be unduly raised, must use caution and discretion in making qualitative (and even in wording, quantitative) reports. That is, the report should attempt to show if the amounts reported to a layman or prospector are of economic significance. Of course, a negligible percentage of a rare element, say Germanium, might be so today and tomorrow might tell a different tale. To the scientific worker attempting to identify an old or a possibly new material or engaged in a research, no such restrictions apply.

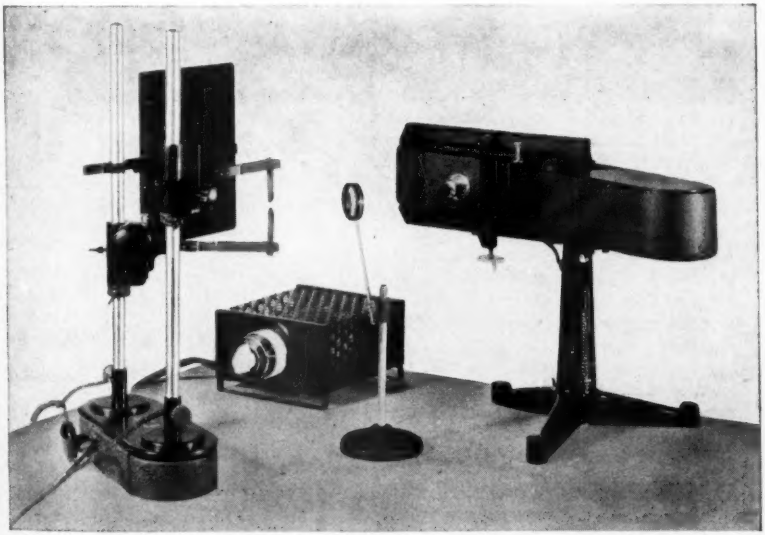
Finally, it might be of interest to touch briefly on one common method of taking a spectrogram. A small piece of a mineral or a finely powdered ore or rock is placed in a hole or crater drilled in a specially prepared graphite electrode; usually the positive one is so employed. If the mineral is a non-conductor, the piece must be ground and mixed with powdered carbon to assist in carrying the current and thus induce rapid heating and vaporization. When an arc is struck, using 220 volts D. C. and say 5 to 15 amperes, the burning material gives off copious light as the molecules and atoms are broken up into electrons. The temperature is up in the thousand degrees. This light in the simple type of spectrograph passes respectively through a slit,

a collimating lens, a prism, a camera lens and finally reaches the photographic plate or, as it is sometimes, film. The slit admits a beam of the desired light, the collimating lens directs the light from the gaseous metal, the prism breaks it up (as does a dew-drop) into its various colors or wavelengths and the plate registers the latter.

Iron, for example, has between 4000 and 5000 lines of known wavelength and is used for reference or calibration by spectroscopists. Lead has comparatively few lines. **For each element the lines are known** and **are characteristic.** In other words, they are finger prints. These lines come from the break-up of the atom while bands come from the molecule.

The spectroscopist, knowing the lines of each element and which ones to use, for some are brighter or more sensitive than others, employs them not only to identify the element, but in many cases to measure the percentage present. Roughly speaking, the more of an element present, the brighter are the lines of light emitted, and, naturally, the darker are their traces on the photographic plate and, up to a certain point, the greater the number of lines that appear.

Summed up, the spectroscopist may qualitatively detect any metal and some of the metalloids or semi-metals. He is rapidly increasing his ability to detemine quantitatively many of them in amounts at present best below .25% or perhaps 1%, though a few procedures have been developed that will go up to 5%. Put another way, the scope of the method, superior as it already is in many respects to composition analysis, is growing every day. It has its limitations; for example, the good old assay methods for gold and silver still find their use in our laboratories and will for some time, but prop-



Courtesy Bausch & Lomb.

SMALL LITTROW SPECTROGRAPH

Complete with accessory equipment set up for use. On the left is the arc and spark stand with rheostat in the background. In the center stands the condenser which focuses the image of the light source upon the slit in the spectrograph.

erly used the mineralogist finds a spectrograph a very potent instrument, especially when looking for rare elements or those suspected of being present in small amounts when proving qualitatively the composition, or studying compositional differences between any number of specimens. Last but not least, the spectral plate gives him a permanent record.

The cost of instruments is relatively high but the cost of the determinations is often less, even with greater assurance and precision, than those by chemical analysis. Much more will be heard of this method of analysis and mineral identification in the future.

SOOT-COATED SELENITE FROM ROA HOOK, N. Y.

By PETER ZODAC

Editor, ROCKS and MINERALS

Roa Hook is the name of a locality one mile north of Peeksskill and on the east bank of the Hudson River. It contains two houses, ruins of a cement block plant, a small abandoned gneiss quarry, and an abandoned gravel pit. A covered platform along side of the N. Y. C. railroad station serves as a military station for Camp Smith, a national guard encampment about one-half mile to the east.

About 500 feet north of the military railroad station, which is but 50 feet from the river, is a small railroad cut possibly 150 feet long. The beam of an old turntable has been placed overhead, at the cut, to serve as a footbridge. The rocks in the cut are so encrusted with soot from passing locomotives that their identity cannot be ascertained from a cursory glance but they are apparently gneiss with one or two small pegmatite intrusions. About 50 feet from the northern end of the cut and along its western face, is one of the pegmatite dikes. Chips broken off the dike show microcline and augite of good quality but it would require blasting (which would never be permitted) if good specimens were to be obtained. About 8 feet above the ground and near the pegmatite dike, mossy-like masses of a deep black color fill small cavities and hollows formed when the rock was originally blasted out for the cut. The black masses, much darker than the surrounding rocks, are very soft and fragile and can easily be removed with the fingers from their attachment. To those not familiar with the minerals of the Hudson Highlands, the identity of this black mineral might be a puzzle. It was recognized immediately as a drusy form of selenite, a variety of gypsum. Selenite, commonly, is a colorless mineral but the material found in the cut was so encrusted with soot, that the black coloration could not be removed even when washed in water. It may even be possible that the soot may have crystallized out as carbon and associated itself with the gypsum.

Selenite is a secondary mineral and was formed after the cut was blasted out. The railroad was put through around 1850, and if the selenite began to form that very year it would now be 88 years old. It is undoubtedly much younger than that. Masses of selenite 8x5x1½ inches thick were collected. The mineral when crushed stains the fingers but slightly. It is neither fluorescent nor phosphorescent under the cold quartz lamp.

THE PRINCIPAL COMMERCIAL MINERALS

By JONATHAN McC. BLAIR

Forward

Among the economic minerals should be placed the indicative minerals and striking surface ores. Although they may be of only minor economic importance, they are major guides in the discovery of important deposits. These minerals are grouped, so far as possible, according to their relative economic importance, so that a nucleus elementary collection could be formed by acquiring the first mineral under each heading. Distribution is a factor of the relative economic importance of minerals. Therefore the factors of distribution, indicative value, and economic importance are correlated.

METALLIC MINERALS

Aluminum

Bauxite. The ore of aluminum.

Sillimanite, Cyanite, Dumortierite, Andalusite. Mainly used in the manufacture of spark plugs and refractories.

Antimony

Stibnite. The common mineral of antimony, and the chief source of antimony.

Arsenic

Arsenopyrite. A common arsenic mineral. Supplies most of the world's arsenic.

Barium

The chief minerals are barite and witherite.

Barite.

Witherite.

Beryllium

Beryl. Beryl is the ore of beryllium. A growing market for the ore is reported. The metal beryllium and many alloys, particularly with copper, are on the market and have many uses in machinery and chemical industries.

Bismuth

Bismuthinite. The principal bismuth mineral.

Cadmium

Cadmium is a metal of growing importance, generally found in zinc ores, from which it is saved as a by-product. Greenockite is the only mineral of cadmium.

Greenockite.

Chromium

Chromite. The only chromium mineral ever used as an ore.

Cobalt

Cobaltite, smaltite, and linnaetite are the commercial cobalt minerals.

Smaltite.

Cobaltite.

Linnaeite.

Columbium and Tantalum

The three most important minerals are columbite, tantalite, and samarskite.

Columbite. Columbite and tantalite are much alike, and only the trained mineralogist and chemist can tell them apart. Both contain iron, manganese, columbium, and tantalum. Tantalite is rare.

Copper

There are more than 100 copper minerals, but a prospector need be able to recognize only about 10.

Chalcopyrite. The most common of all copper minerals. It is the mineral from which nearly all the other copper minerals are usually formed either directly or indirectly.

Chalcocite. An important ore.

Malachite. It has the distinctive green color so often ascribed to copper and is one of the best surface indications of the metal.

Cuprite. An important source of copper.

Native copper. Native copper may be a product of weathering of other copper minerals, and as such is usually an unimportant part of the ore and is found only near the surface. Most copper veins show a little native metal.

Gold

Native gold.

Calaverite. The most important of the tellurides.

Hafnium

Baddeleyite. The unaltered zircons, the native zirconium oxide (baddeleyite), and eudialyte are more abundant and the more important of the leaner hafnium ores.

Cyrtolite. The richest hafnium ore.

Iron

There are only four industrially important minerals of iron, although there are several hundred minerals that contain iron.

Hematite. The most common industrial iron ore, and the most abundant of all the iron ores.

Limonite. The second most common industrial iron ore. Mineralogists will distinguish between goethite, turgite, and limonite, but they are all closely similar and of practically the same composition; hence it is needless to distinguish between them.

Magnetite. The third most common industrial iron ore. Massive magnetite is the highest grade of iron ore.

Siderite. The fourth most common industrial iron ore.

Lead

Galena. The principal mineral of lead. In some gold areas it is a good indication of gold and should be followed.

Manganese

Pyrolusite. Wad somewhat resembles pyrolusite, but there is no need to distinguish between the two, as they are both good ores. Pyrolusite is mostly used as the chemical ore.

Psilomelane.

Rhodonite. Rhodonite has too much silica in it to be of value as an ore unless mixed with purer ores.

Mercury

Cinnabar. Virtually the whole supply of the world is derived from cinnabar.

Molybdenum

There are only two common minerals of molybdenum, viz., molybdenite and wulfenite.

Molybdenite.

Wulfenite.

Nickel

Pentlandite. Pyrrhotite that has pentlandite in it is sometimes called nickeliferous pyrrhotite.

Garnierite.

Niccolite.

Millerite. Formerly more abundant, now quite rare.

Rare-earth Metals

There are nearly 20 metals that have been termed "rare earths," but few of them have any value for manufacturing purposes.

Monazite. This is by far the most important mineral of the rare-earth group. Contains 3-9% thoria.

Samarskite. This contains the rare-earth metals and tantalum and columbium.

Thorite.

Silver

Argentite. The most important and common of silver minerals.

Cerargyrite. A surface ore.

Native silver.

Strontium

Strontianite.

Celestite.

Tin

There are only two tin minerals—cassiterite and stannite. Cassiterite is the source of the world's tin, and stannite is uncommon.

Cassiterite.

Titanium

There are several minerals containing titanium, but only two are ever a source of that metal, viz., rutile and ilmenite.

Ilmenite.

Rutile.

Tungsten

The principal minerals of tungsten are wolframite, ferberite, hubnerite, scheelite.

Scheelite.

Wolframite.

Hubnerite.

Ferberite.

Uranium

All uranium minerals contain radium, and many of them contain vanadium. There are fifteen uranium minerals, but only two—carnotite and uraninite—are of importance.

Uraninite. Contains uranium and radium.

Carnotite. The principal source of radium in America. Contains uranium, radium, and vanadium.

Vanadium

While vanadium is contained in some uranium minerals, all of which carry radium, no vanadium minerals except carnotite contain uranium or radium.

Vanadinite.

Carnotite. Yields a good proportion of the vanadium of this country.

Descloizite. Especially important in South Africa.

Zinc

Sphalerite. By far the most important of all zinc minerals.

Smithsonite. Not an important ore of zinc but significant, as it may indicate a body of sphalerite deeper down. Seldom found below a depth of 20 ft.

Zirconium

Besides zircon and baddeleyite, about a half dozen other extremely rare zirconium minerals have been found.

Zircon. By far the most abundant and widely distributed mineral of zirconium.

Baddeleyite. Greater zirconium content than zircon. Rare except in Brazil where rather large quantities are found.

NON-METALLIC MINERALS

Abrasives

Emery.

Diatomite (diatomaceous earth). Sometimes incorrectly called infusorial earth, kieselguhr, tripoli. Used for polishing metal, in filters, as an absorbent, but mostly as an insulator.

Tripoli. Harder than steel. Mostly used in making water filters of all sizes, also for polishing, in molds at foundries, as a filler in paint, and in rubber.

Asbestos

Chrysotile. The common mineral. The electrical industry requires asbestos free from iron. Long fibers are used in spinning yarn and cloth; short ones are used in boards or sheets including admixture with cement, shingles, brake bands, and insulating material.

Borax

Colemanite. Formerly the commonest source of borax in the U. S.

Kernite. The chief source of borax today.

BUILDING OR DIMENSION STONE

Indiana colitic limestone. One of the principal types of stone used in the U. S. Enormous quantities available.

Sandstone.

Granite.

Marble.

Slate. Mainly used for roofing purposes, but large quantities are consumed in making table tops, switchboards, tubs, flooring, and such.

Serpentine.

Verde antique.

Onyx marble.

Orbicular gabbro. In demand. Uncommon.

Clay

Fireclay. Used in large quantities in refractories.

Kaolin (china clay). The purest of the clays.

Fuller's earth. Used for decolorizing oil and fats and has the property of retaining the coloring matter therein, by filtration. Not plastic, cannot be molded or worked like ordinary clay.

Cryolite

Cryolite. Used in the production of aluminum. Greenland has the only known workable deposit.

Feldspar

Feldspar. Good feldspar has a market at potteries, glass and enameling works, also for bonding emery and corundum wheels. It is a future source of potash.

Precious labradorite. A gem.

Moonstone. A gem.

Fluorite

Fluorite. Clean ore has a ready sale for the chemical, pottery, and steel industries.

Gemstones

Agate

Agate. Large pieces are polished for table tops. Also shaped into small pestles and mortars for laboratory use.

Beryl

Aquamarine.
Emerald.
Moralla. An emerald mineral of no value, but an indicator that stones may be near.

Corundum

Sapphire, blue.
Ruby.

Diamond

Diamond. The South African and Belgian Congo white diamond is superceding Brazilian carbonado for diamond-drill crowns.

Garnet

Almandite. Extensively used as an abrasive.
Grossularite.
Spessartite.
Pyrope.
Rhodolite.

Jade

Nephrite.

Opal

Precious opal.

Tourmaline

Tourmaline.

Turquoise

Turquoise.

Graphite

Graphite. The "lead" of lead pencils is a mixture of graphite and fine clay in varying proportions to make them hard or soft. The same applies to crucibles used in melting metals. Graphite is also consumed in lubricants, rubber tires, foundry molds, polish.

Gypsum

Gypsum. Used in large quantities in many industries but especially in building construction (plaster and board) and cement manufacture.
Anhydrite.

Hydrocarbons (natural)

The natural hydrocarbons are gilsonite, elaterite, wurtzilite, glance pitch, manjak, grahamite, albertite, ozokerite, and many other minor varieties.

Gilsonite. In demand for use in many common articles.
Ozokerite.

Limestone and Lime

Limestone. As much as 150-million tons are mined each year for use in agriculture, chemical industries, fertilizer, lithographic stone, flux at smelters, plaster, glass, building purposes and portland cement.
Marl. In great demand for the manufacture of portland cement, of which it constitutes up to 75%.
Chalk.
Flint. The flint pebbles found in chalk are in demand at ore-treatment plants for grinding.
Calcite. Seams of calcite are an indicator for cement rock.
Lithographic limestone.
Greensand marl. Used for fertilizer.
Iceland spar. When sufficiently transparent and free of defects it is used in the manufacture of optical instruments. While the actual demand is small, the degree of purity and physical perfection demanded renders it somewhat difficult to obtain suitable material. The crystals must be free of cracks, cloudiness, and twinning. Prices of $1-$20 per lb. have been realized. The recent invention of the synthetic material Polaroid will probably displace iceland spar as a factor in industry.

Magnesite

Magnesite. The ore of magnesium. Magnesite itself is in large demand for furnace linings, brick, plaster, mixing with asbestos to make board, and for chemical purposes.
Brucite. Used the same as magnesite.

Mica

Both sheet and scrap mica of good quality are in demand. This mineral is flexible, elastic, and does not conduct heat or electricity, properties that no other mineral has. Makers of electrical

machinery and goods are large consumers.

Mica schist. This rock has some market for lining furnaces. If good blocks are minable, smelting companies and foundries will buy it for this purpose.

Muscovite. A good indication for tin, as it always exists in the granite in which tin is found.

Vermiculite. Since 1925 vermiculite has become of industrial importance. The only surface indication is a slippery soil composed of mica-like flakes. Vermiculite is not used as mined, because on heating it expands and unfolds to 20 times its original bulk, changes in color to silvery or golden, and decreases in specific gravity from 2.5 to 0.09 and in weight from 100 to 6-20 lbs. per cu. ft. The treated mineral is mainly used for insulating purposes, but vermiculite is suitable in plaster, roofing composition, cement, lubricant, and "gold" paint.

Mineral Fuels

Bituminous coal. In great demand for homes, steam, gas, and coke. Soils the hands and emits considerable smoke when improperly burned in furnaces or stoves.

Anthracite. When burned it gives off no smoke and does not soil the hands.

Lignite. Little demand for it except locally, for it cannot be stored or shipped long distances.

Brown coal. Probably the next stage of coal formation after peat. Burned as in power plants and is made into briquets for household and industrial purposes.

Mineral Pigments or Fillers

Ocher. Golden-yellow, can be burned to form so-called 'red ocher'. Red ocher occurs naturally and can be made artificially.

Umber. Raw umber is drab but turns reddish-brown on burning. The burned material is called 'burnt umber'.

Sienna. Raw sienna is deep yellow and when burned becomes dark red.

Nitrates

Used mainly as fertilizers and in explosives. The discovery of a domestic deposit would be worth a great sum.

Caliche.

Petroleum and Natural Gas

Crude oil.

Oil-shale. Contain an average of 20 gals. oil per ton. When the resources of ordinary petroleum are exhausted these shales will be mined and treated. Oil-shale contains no oil as such, yet carries the essentials, which, on being heated and condensed, yield oil and distillates of good quality.

Phosphate Rock

Phosphate rock. If deposits are found reasonably near to works where sulphuric acid is made and near where the manufactured product may be sold to farmers, they are worth attention. Some phosphate rock is ground and applied raw to the soil.

Apatite. Contains up to 42% phosphoric acid.

Potash

Alunite. Contains 11% potash.

Polyhalite.

Leucite. Contains 21.5% potash.

Feldspar. Carries up to 17% potash and is a possible future source, but is in demand for china and porcelain industries.

Pyrite

Used as a source of sulphur, of which it contains 53%, when pure.

Pyrite. When fine crystals of pyrite exist in a quartz vein or lode formation, they are a fair indication of the possible presence of gold. The large crystals are generally of no value as indicators.

Salt

Rock Salt.

Halite. Halite has the distinction of being the mineral most largely used as a food. Other minerals furnish food for plants and thus indirectly sustain the life of man, but halite is the only mineral

which is eaten in its natural state. It is also one of the most useful of minerals in chemical and manufacturing industries—glass manufacture, chlorine and soda works, etc. Both halite and sylvite are highly diathermous, allowing free passage of heat as other transparent bodies allow passage of light, and cleavage blocks are used to inclose gases in a tube with transparent ends which will readily transmit heat rays.

Sylvite. Sylvite is the 'sal digestivus sylvii' of the old pharmacists, and has long been used for medicinal and chemical purposes. Saline, but bitter.

Sand and Gravel

Building sand.

Molding Sand.

Glass Sand.

Silica

Chalcedony. If in quantity and near cement works or gold and silver mills where tube-mills are used, it is of value for grinding purposes. Generally it must be rounded before use.

Sulphur

Sulphur.

Talc and Soapstone

Talc. A large quantity of ground talc is consumed each year. The principal uses are for filler in paper and rubber, face powders, medicinal purposes, pencils, eiectric insulators, and paints.

Fibrous talc. The fibrous form is required for the paper industry and paints, and the finest grades for toilet purposes and pencils. The increasing use of talc in fire-resisting paints provides a good market for the future.

Soapstone. Mined and sawed into blocks of various sizes for use in table tops, tubs, switchboards, scientific laboratories, fireless cookers, and for electrical purposes.

AMERICAN MUSEUM LECTURES

The American Museum of Natural History, Department of Education, offers a free course of four informal talks on "The Appreciation of Gems", by Herbert P. Whitlock, Curator of Minerals and Gems, given Saturday afternoons at 4:00 P. M., April 23, 30 and May 7, 14, 1938, in Room 319, Roosevelt Memorial of the American Museum of Natural History, Central Park West at 79th Street, New York, N. Y.

April 23

What Is A Gem?

Presents in a very generalized way the relations and differences between gem stones, and answers some of the questions that occur to the layman concerning them.

(Lantern slides.)

April 30

Diamonds: From Mine to Market

Follows the travels of a diamond from its home in the earth to the shop showcase, and shows how its beauty is brought out by the diamond polisher.

(Lantern slides.)

May 7

Famous Diamonds of the World

Tells the dramatic stories of these gems, many of which have actually made history.

(Illustrated with Models.)

May 14

Jade: Its Carving, Mythology, and Symbolism

Explains how the Chinese have expressed in carved jade the wealth of myth and legend that is an intimate part of their lives.

(Lantern slides.

FAST MOVING WHEELS AND MINERAL COLLECTING

By JAMES A. TAYLOR

Glen Ridge, N. J.

During last July, I conducted a family excursion covering three thousand miles through Montreal, Quebec, the Gaspe Peninsula and Nova Scotia. The purposes were as diverse as to membership, scenery, travel, fishing, pictures, and minerals as the minor element for the titular head of the house.

We travelled six hundred miles on July 6 and 7, the hottest of the summer and spent the second night in Quebec which was just as hot as New York. A skimming of the historical sights and we were on our way to St. Anne de Beaupre and the stack of crutches, and just outside the town the most vicious hill of the whole trip. For a minute I thought first gear was not good enough. Thence to Murray Bay to find that the bay was a mud flat at low tide and they neither swam nor sailed on it. We arrived just in time to see the first big commercial transport from Europe thunder up the River. From St. Simeon we crossed to Reviere du Loup on a ferry and were at last on Gaspe. We stopped for the night at the Metis Beach early enough to have a swim and that was something. I am not sure of the temperature at which salt water becomes crystalline but a drop of a degree or so and I know we would have walked on it and not in it. Rigor mortis is just slightly different. It was cold water.

We had been warned to do the Gaspe from west to east because of the breath strangling hills and cliffs where the outside lane would make you ga-ga. Curiously enough I did not see any such places and in my opinion it makes no difference which way you go. When you meet a high cliff you turn inland or go along the bottom. It is a picturesque, rugged shore with many magnificent scenes. It is most sparsely settled but every impoverished little fishing settlement has a huge stone cathedral church. All the inhabitants make hooked rugs. Inland is not settled at all but is a vast wooded-hill wilderness. The Peninsula is twelve hundred miles around and all sand-gravel roads—good when there has been a little rain. We had had none in three weeks and every passing car gave us a blast of dust.

Mines or mining districts on the Gaspe seem to me to be conspicuous for the money that has been sunk in them in a vain hope of finding a paying deposit. For the most part the mines are just prospect holes for lead and zinc. I had sent for all the government reports on the Gaspe and without exception the operations were the following of thin stringers down into the rock until they pinched out. Some of the prospects show a very slight trace of gold and some copper but nothing so far in paying quantities though numerous traces appear in many parts of the Gaspe. The first location on the end of Cape Gaspe I passed, as well as the second near Douglastown, because the description did not seem to warrant the trouble of stopping.

We stayed a night at Gaspe Village and then three days at Perce Rock, the loveliest sight on the trip and really worth seeing. Bonaventure Island is six miles off shore and we went there three times. It is a national seabird sanctuary with towering cliffs overhanging the water literally swarming with gannets, herring gulls, auks, cormorants, puffins and others. It was an amazing sight for a landlubber. On the second visit we brought our lunch for I was insistent on getting some of the famous Bonaventure agates. The family combined found three or four little pebbles and I hammered a two inch specimen out of the hardest conglomerate of my experience. I guess they are well mentioned because so scarce.

My real objective on the trip was the lead-zinc mine "near" Cascapedia of the Federal Zinc & Lead Company. It was raining when we arrived at the

town, one hundred and fifty miles west of Perce. Inquiry developed that there was a custodian at the mine who "would take care of us all right." The mine was just fifty miles due north in the mountains but the road was "pretty good." I learned from this never to believe anybody. The road was rotten, fifty miles of mudholes, bumps and water with miles at a time when but one car could make it between the crowding bushes. I suppose in dry weather it might have been all right but in a splashing rain with a heavily loaded car it was tough going. We got there about 7:00 p. m. The mine buildings were visible two miles away on the summit of Federal Hill and the road had to spiral all around that hill. It was steep. I have rarely been so uncomfortable and chagrinned when I found that the custodian, a rare good sport and a splendid chap, Jim McWhirter, was not equipped to provide for anybody. He had barely enough food for his own family and no provision for sleeping. It was too late to go back so he made the best of it and gave us the bunkhouse that was attached to the old office and four blankets. What passed for mattresses were on slats—no springs, no pillows, no sheets. I put firewood under the mattresses for pillows, towels for pillow cases and our coats and rugs for the rest. We had a good supper, I fear at our host's sacrifice, and tried to take a walk through sky blackening masses of mosquitoes (on the top of a bare mountain). I had a few minutes on the dump but rather futilely in the gloom. The boys slept at once, I intermittently, and my wife little. Every time I awoke and turned over I had to grin thinking of my wife's oft expressed desire to "rough it." She did. Lord, but those beds were hard. Next morning—still raining—I went over the dump pretty thoroughly. There was plenty of sphalerite—of the honey yellow kind which I found later did not fluoresce as I had hoped, siderite, galena, calcite, pyrite and a lot of good quartz crystals—most of which I could not take along because of the loaded car. I also found several small unidentified crystals. The Company, which had been closed down five or six years, had a fine plant, a four hundred foot shaft with tunnels, an expenditure of $400,000 and had never smelted a ton of ore. Following stringers seems hardly profitable. The trip back was about as bad as going but quicker because I knew what to expect.

We then did four hundred miles in a pouring rain through New Brunswick, three hundred of which were over roads under construction and vile. And the scenery, if any, did not particularly appeal to us.

We all thoroughly enjoyed Nova Scotia with its warm days and cold nights and relatively good roads—some of them really good. Next year when the roads are all fixed the travelling should be much better.

There was one place I was determined to visit and that was Partridge Island at Parrsboro on Mina Basin. We stayed overnight at the Ottawa House, half a mile from the Island which really isn't one because it is connected by a neck. The family said it could not be done but I silenced a traditional slander by getting up unaided at 3:30 a. m. and making for the "Island." The tide rises twenty-eight feet and was low at 3:30. To get around the three or four miles of shore, where the high cliffs made it impossible to pass at high tide, required hard going. The rock is trap and the usual trap minerals are there. I wasted a lot of time looking for agates. I found some but they were poor but some of the stilbites I got were splendid specimens. They fall from the cliffs to the beach. I suppose some of the good ones fall in the water and hence are not injured. I worked like a non-union worker for what seemed like half a day, staggered the last mile with forty pounds of specimens and just beat the tide around the last corner. I was home at 8:30 and ready to eat. Wasson's Bluff was a few miles down and we went there to contact John Wasson. I did not go to the Bluff but got from him some very nice red chabazite. He

keeps his stuff in boxes in a shed. He attempted over my protest to ignore a nest of bumblebees in one box. The only solace I had for a dirty sting was that he got two.

After forty miles over roads under construction we passed through Truro to Halifax, a very interesting old city. We spent the night some thirty miles beyond. We found the only really interesting antique shop of the trip near here and ran loose in it. These places are more dangerous than mines.

From there to Greenfield and a well known salmon fishing camp. We spent three delightful days fishing but got no salmon because a week of heat had driven them all to the bottom of the pools. Every day we went down to White Point for a hair restorer swim on the only fine beach we saw. The water seemed to have removed only recently from an iceberg but it left you full of desire to do something and while cold did not seem to chill.

From there to Bridgewater, past a gold mine they were not working for cause (having put in $50,000). It was too far off the course to visit. Thence to Windsor where I visited a big gypsum mine. I walked right in, took what I wanted and being an hour late for the rest of the family I was ready to go when a big foreman told me to get out or he'd arrest me. I mildly disagreed on the latter and he said if I did not "get the hell out in a hurry" he'd show me. I got some interesting gypsum of various colors, selenite and massive anhydrite but no crystals. Thence through the Annapolis Valley to Digby and Digby's Neck where in a few minutes on a beach I found some natrolite and a couple of unidentified small crystals. I believe further search here might have uncovered something worth while.

We crossed over to White Point again to the comfortable lodge there and a couple more swims—thence to Yarmouth and the boat to Boston and home.

I'd enjoy going again and this time to visit localities I had read of but could not visit: Hillsboro near Moncton, the Bridgewater gold mine, Cape Blomidon (though they say good specimens are now hard to get), the coal mines north of Truro, and other interesting sites.

A Collector's Paradise

One of the greatest mineralized regions of the East is the area around Spruce Pine, North Carolina. Spruce Pine is in Mitchell County, in the extreme western part of the state, its population is about 1,000, and its altitude 2617 feet above sea level. With Spruce Pine as a center you can literally go in any direction, follow any road or stream, traverse any field, or climb any mountain and before you go ½ mile you will run across at least one mine or quarry if not five or more. The area around Spruce Pine is simply dotted with quarries in which fine mineral specimens abound. The quarries are operated mostly for feldspar and as many of them are underground workings they are called mines. Autunite, clarkeite, columbite, emerald, epidote, gummite, hyalite, monazite, samarskite, sphalerite, thulite, uraninite, uranophane, are but a few of the minerals which occur here.

THE BIRTH OF THE EARTH

By WM. SULZER
Former Governor of New York

More than a billion years ago, as we reckon time, the earth was born. It was born like everything else. Everything in the animal world, the mineral world, and the vegetable world is born, and lives, and dies. The union of a male and a female produces birth. All life is the union of these forces. This is the primal law of the stellar universe. It runs like a silver cord through all matter. Even the great stars are born.

Our Earth is a member of the Solar system, the third in distance from the sun, and the largest within the orbit of Jupiter. Its spherical form was taught by Pythagoras, and other Greek thinkers and teachers. Its natural history is the most interesting, instructive, and educational in literature. Besides it plays an important part in astronomy, as the diameter of the earth is the unit by which all celestial distances are determined.

Scientists have enunciated several theories concerning the birth of the earth, but I do not agree with these theories, and some of them have been exploded. From much thought, investigation, and observation, I believe I have discovered the truth about the birth of this little planet, on which we live, and which we call the earth.

The biggest thing in our ken, and this has been so from primitive times, is the small star we call the sun, far out in space from the Island Universe we call the "Milky Way". In early times the people worshipped this little star, because it gave them light and heat, and other essentials to life. The sun-worshippers were the first true religionists, and the ancient cult has today a substantial following throughout the world. Nearly all gods are sun gods, and all religions have been built from them, and around them.

Although the sun has been studied since civilization began it is only in recent years that science is finding out a few important things about it. Our sun is the creator, and the only agency that creates. The word "creator", or "creates", or "created", should never be used by writers or speakers except in reference to our sun. The sun, in the last analysis, is "Old Mother Nature". The sun is the mother, and should always be called She. Our little planet, called the earth, is just one of her children. How did this occur? That question I shall now answer.

Billions and billions of years ago our star, called the sun, was a double star. There are many of these double stars in the stellar universe that can be seen through the great telescopes. Our star was then a female star, and much smaller than it is now, but it was growing into womanhood. Approaching it was a larger start, that had reached its maturity and was a male star. Then these two stars met and were married. This celestial union was the greatest sight to be witnessed within the sphere of our solar system. Only a vivid imagination can visualize its glory and its grandeur. From the marriage of these two stars — male and female — were born the earth, and all the other planets; and doubtless there are other undiscovered planets, of which we know nothing at present; but they are all the children of the marriage of these two small stars far out from the Milky Way.

The male star, of course, after the marriage, died and was absorbed by the female star called our sun. As the children were born they went out, and were distributed in space, but always watched over, and controlled by their wonderful mother—the sun. When they left their mother they were in a gaseous state. How long this lasted we have no knowledge, but the gases gradually cooled into liquids, and some of the liquids then became solids, and the planet earth, after millions and millions of years, was formed, and grew slowly; and is still growing, and changing, through forces and agencies of its mother, which I will refer to in my next article entitled: "How Old Is Sol?"

A UNIQUE COLLECTION OF QUARTZ CRYSTALS

By Prof. HAROLD O. WHITNALL

The Museum of Geology at Colgate University contains a remarkable and unique collection of quartz crystals. Known for over one hundred years as "Little Falls diamonds" these crystals have long been sought by the professional as well as the amateur collector.

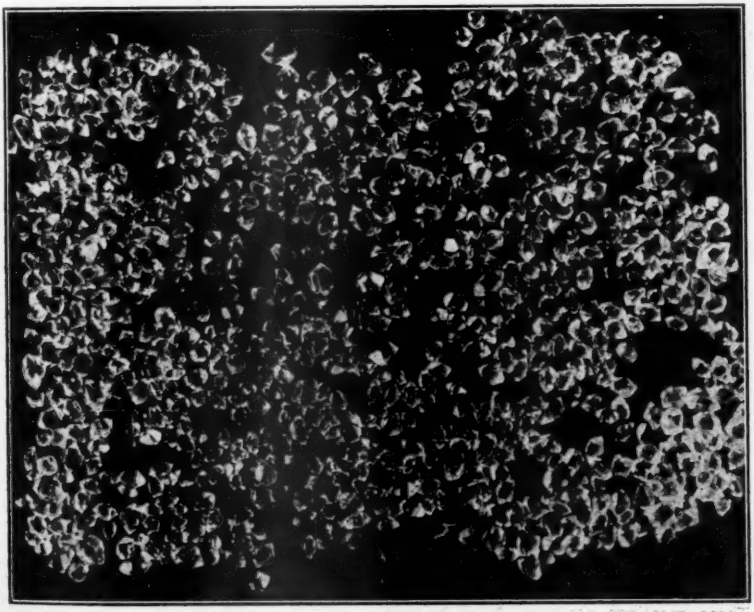
In the Colgate collection are over 100,000 perfect crystals ranging in size from a walnut to ones smaller than pin heads.

They were collected over a period of many years by Mr. John H. H. Vosburg. The gathering of these perfect forms was Mr. Vosburg's hobby for over fifty years. Every crystal was selected and there is no poor or incomplete one in the entire collection.

The "Herkimer" or "Little Falls diamonds have been studied by mineralogists for a century. Dr. Lewis C. Beck, M. D., the author of the Mineralogy of New York State, published in 1842, tells that the attention of the public was first called to the abundant occurrence of these crystals by Dr. J. Hadley of the Geneva Medical College in the New York Medical and Physical Journal of 1836.

The formation from which the "diamonds" are derived is the "Calciferous Sand Rock" of the early New York State geologists or the Little Falls dolomite of the present nomenclature. Whether the Little Falls member is Cambrian or Ordovician is still a debatable question among geologists.

The character of the quartz-bearing rock is a limy sandstone. In many places it is of rather loose texture and permits easy seeping of waters. Through the ages the action of the water has produced



A TRAY FULL OF TINY QUARTZ CRYSTALS

B A

Vial A contains 15,000 minute quartz crystals.

Vial B contains 25,000 minute quartz crystals.

cavities or geodes in which clusters of quartz crystals have gathered. Numerous crystals contain liquids and many of them have specks of a black substance which is closely related to asphalt.

While the crystals are often found lining the geodes, the better ones are usually picked up in the weathered rock which has passed into soil. The best time to seek them is after a torrential rain when the lighter soil has been washed away and the crystals are near or at the surface.

Returning to the collection at Colgate University, the illustrations show (A) a small vial measuring 5/8x1/4 inch which contains 15,000 perfect minute quartz crystals. (B) shows another vial 1 1/8x3/4 inches which has 25,000 crystals of a slightly larger size. Also one of a score of trays of these beautiful crystals.

Aside from these samples of the exhibit there are thousands of various sizes both in clusters in geodes and as single specimens. This priceless collection is, as befits its uniqueness, housed in a specially built case.

Marquette Geologists Association

The annual meeting of the Marquette Geologists Association was held on January 8, 1938, at the Marquette Institute, located at 155 North Clark Street, Chicago, Illinois. The following officers were elected for the coming year: Mr. H. C. Walther, Chairman; Mr. William E. Menzel, Vice-Chairman; Mr. George J. Huss, Secretary-Treasurer.

Regular meetings are held on the first Saturday of every month at the hour of 7:30 o'clock P. M.

In addition to our regular meetings we have "Study" meetings at which we study mineralogy and blowpipe analysis. These meetings are held on the third Saturday of every month at the above address at 7:30 o'clock P. M.

Lectures on subjects of interest to members are a feature of our regular meetings. At our last regular meeting Mr. Adam Kahn spoke on the cutting and polishing of gem stones. Guests are always welcome.

Removal Notice

One of our advertisers, Wilfred C. Eyles, whose address was formerly 5051 Geary Blvd., San Francisco, Calif., is now located at 2025 Foothill Blvd., Oakland, Calif.

FOSSILS AND FOSSIL COLLECTING

By IRVING G. REIMANN, Curator of Geology,

Buffalo Museum of Science

PART II. FOSSILS WITH SOFT TISSUES PRESERVED.

It is an almost invariable rule that the soft parts of creatures decay or are eaten after their death, and that only their relatively indestructible hard parts are preserved as fossils. It is almost beyond belief that soft parts could be preserved **unchanged** for thousands, and even millions of years. Yet, if buried by nature in the proper medium, insects, leaves, blossoms, the woolly mammoth, and the woolly rhinoceros may all be found today almost as fresh and intact as when they met their death.

About fifty million years ago in the Baltic region of Europe there grew a great forest, rich in insect life. Some of the trees exuded a gum to which many insects were attracted. Settling on the sticky substance they were trapped, and their struggles only served to attach them more and more securely. Now and then dainty blossoms, floating in the wind, would become stuck against the soft resin. Later oozings of resin would cover both insects and blossoms and seal them against all agents of decay. Time destroyed the forests, but in the Oligocene strata of that area are now to be found, with pieces of petrified wood, globules of amber, the ancient resin which has become a gemmy tomb containing the lifelike-appearing insects and blossoms of that ancient time.

Recent erosion cutting into the strata has uncovered great quantities of this amber (succinite) which waves and currents have distributed as far as Great Britain. The collector should be wary of purchasing insects in amber, however, because it has been a common practice for many years to melt bits of amber and throw recent insects into it. These frauds are then cut, polished, and sold to tourists.

Although amber has been found in many localities in the United States, particularly along the Atlantic coast, there appears to be but one report of an insect in American amber. In the upper Cretaceous Eutaw formation at the Coffee Bluffs in Western Tennessee a single specimen containing the wings of a caddis fly has been found.

In Dana's classification of minerals, No. 223 is a very common mineral known as water which in its solid form is called ice. Ice happens to be the agent of preservation which has yielded us our best-preserved mammoths. Several have come to light recently, but these frozen carcasses have been known to occur in Siberia for a hundred years. Doubtless many have been destroyed as they melted out of the frozen soil, both because they frequently occur in inaccessible or uninhabited areas and because the natives regard them with superstitious awe. Our name for them—"mammoth"—is derived from the Siberian word "mammut," or mole. The natives believe them to be gigantic moles which burrow through the ground, and whose appearance at the surface portends disaster. Dogs eat the flesh and usually partly destroy the remains before scientists can save them, but on the other hand, they have sometimes been instrumental in leading scientists to the find. The story is told that mammoth meat has been served at great banquets as a novelty, and it is also said that many of the guests preferred to preserve their portion in alcohol.

From the contents of the mammoths' stomachs and the bits of their last meal caught between their teeth, we have learned that they fed on plants which still live in the steppes and the tundras. Nature's own cold storage has made our knowledge of these creatures, extinct thousands of years, as complete as that of some of our rarer living forms. We know the color and texture of their coarse reddish hair and underlying wool, their internal anatomy, their form in life, and even their actual diet.

A recent find of great interest, which

we may include in our mention of fossils preserving soft tissues, was made a few years ago in Gypsum Cave, Nevada. There, sandwiched between layers of cave deposits containing human remains, were found parts of a ground sloth—a claw, tendons, and patches of skin and tawny hair—stlil preserved in the guano-rich cave deposits. While this served to focus our attention on such relics, preserved and dried out in moistureless caves, the great importance of this find lay in the proof it presents of the contemporaneity of the extinct sloth and man. In addition to this it has caused some speculation as to whether early man in America may have domesticated the sloth, whether the sloth lived more recently than hitherto suspected, or whether man in America is older than formerly supposed. Fine-grained, dense clay may, by the exclusion of air, circulating water, bacteria, etc., act as a preserving medium for various types of organisms, such for instance as leaves, which are ordinarily lost or much altered. Such leaves occur in abundance and remarkable perfection in the Eocene Wilcox formation near Puryear in Western Tennessee. One hundred and eighty-one species have been found in the clay pits there, a larger flora than has ever been collected elsewhere from one horizon at one locality. The leaves, except for a darkening, look like modern leaves lying on the damp layers of extremely fine-trained uniform clay. It is a thrilling experience gently to grasp the petiole of an almost-sixty-million-year-old leaf, carefully peel it from its matrix, and hold it free in the air, better preserved than last autumn's shriveled leaves beneath the nearby trees.

Archaeologists are accustomed to speak of ancient human remains as "fossil man," and acording to. our own definition this is a justifiable term. Near the borderline of historic and prehistoric times, the bronze age, a race of men lived in Schleswig, Germany, who wove cloth, made wooden coffins and implements, and who wore sandals. Their own remains, with those of their ordinarily perishable possessions, have been found in a fine state of preservation in the swamps and bogs of that region. It is a well-known fact that many swamp waters are somewhat antiseptic and preservative in their action, and objects of wood, cloth, and hair may exist without decay for long periods of time, in this instance for three or four thousand years.

The next method of fossil preservation is that in which the soft parts are lacking but the hard parts are preserved. Next month we shall consider a few examples of such fossils.

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THE AMATEUR LAPIDARY

Amateur and professional lapidaries are cordially invited to submit contributions and so make this department of interest to all

MIXTURES FOR DIAMOND SAWS

By E. A. SOUTHWICK

The practice of using a mixture of machine oil and kerosene in the operation of a diamond saw is considered standard procedure, judging from the literature on the subject and the number who follow the practice. In fact, this method is in such general use that no one seems to think of working a diamond saw in any other mixture. It does the work well, probably as well or better than any other method, but it is not an essentially necessary practice, by any means.

There are some who have what the doctors call an allergy for kerosene. There are also people who because of some ailment or medical treatment they are taking, cannot stand this mixture. Still others would prefer using something not quite so dirty and messy as the popular ingredients.

Some have given up lapidary work because of the conditions under which sawing with a diamond saw is done, not knowing any way out of the difficulty. This is unnecessary.

There are at least two other methods that are effective, namely, using water and soap instead of machine oil and kerosene, or using liquid paraffin, which is obtainable at paint stores.

The cheapest and cleanest way of all is to use water and soap, but it is not suited to some types of equipment. If a sliding table of wood is used, the wood will warp unless special precautions are taken to prevent it. The water also has a tendency to rust any iron parts and this has to be guarded against. One of the advantages, besides cleanliness, is that there will be no heating from friction. Furthermore, there is no fire hazard.

Everything considered, probably paraffin is the most desirable medium to use with the diamond saw. Its only disadvantage seems to be the cost, as it is a little more expensive than the kerosene-machine oil mixture. It has some distinct advantages. For one thing, it does not permeate the atmosphere with ill-smelling fumes. It is not so penetrating and harsh to the skin. It is somewhat cleaner to work with. It is not so inflammable as other oils.

To those who do lapidary work only as a hobby, the item of extra expense would be unimportant, for a gallon of the paraffin would last a long time. The fact that its use might be more healthful should more than offset the difference in cost, especially if the use of kerosene has a bad effect on the lapidist. In the case of the commercial shop doing a great deal of sawing, the difference in cost might be worth considering. These methods are not new, but they are not generally used.

The writer is speaking from personal experience. It was necessary to make a change in sawing methods or give up the work. In desperation other plans were tried and the outcome was as outlined above. Perhaps others could tell a different story and the use of the kerosene mixture may not be detrimental to them. But to those who have found the common method of procedure harmful or distasteful and are seeking a change, the above is recommended.